We claim:

1. A compound, comprising a non-protein-binding moiety (NPBM) and at least one protein-binding group (PBG).

2. The compound of claim 1, wherein the NPBM is a polyol, sugar, amino acid, or dendrimer moiety.

3. The compound of claim 1, wherein the NPBM is a polyol moiety; and said polyol moiety is a sorbitol or mannitol moiety.

4. The compound of claim 1, wherein the NPBM is a sugar moiety; and said sugar moiety is a glucose, sucrose, or trehalose moiety.

5. The compound of claim 1, wherein the NPBM is an amino acid moiety; and said amino acid moiety is an arginine betaine, proline, or ectoine moiety.

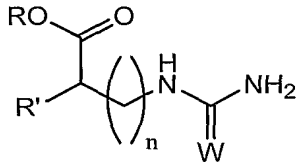
6. The compound of claim 1, wherein the NPBM is a dendrimer moiety; and said dendrimer moiety is based on benzene, pentaerythritol, $P(CH_2OH)_3$, or TRIS.

7. The compound of any of claims 1-6, wherein the PBG is a urea, guanidinium ion, detergent, amino acid, denaturant, surfactant, polysorbate, polaxamer, citrate, chaotrope, or acetate group.

8. The compound of any of claims 1-6, wherein the PBG is a guanidinium ion.

9. The compound of any of claims 1-6, wherein the PBG is sodium dodecyl sulfate.

10. A compound represented by formula **I**:



I

wherein:

R is an electron pair, H, alkyl, aryl, heteroaryl, aralkyl, heteroaralkyl, or an alkali metal;

R' is H, alkyl, aryl, heteroaryl, aralkyl, heteroaralkyl, or $(R'')_3N$;

R" is an electron pair, H, alkyl, aryl, heteroaryl, aralkyl, or heteroaralkyl;

W is O, $NH_2^+(halogen)^-$, or S; and

n is 1, 2, or 4-100.

11. The compound of claim 10, wherein R is an electron pair.

12. The compound of claim 10, wherein R' is H.

13. The compound of claim 10, wherein R' is $(R'')_3N$.

14. The compound of claim 10, wherein R' is H_3N^+.

15. The compound of claim 10, wherein W is $NH_2^+Cl^-$.

16. The compound of claim 10, wherein n is 1.

17. The compound of claim 10, wherein n is 2.

18. The compound of claim 10, wherein n is 4.

19. The compound of claim 10, wherein n is 5.

20. The compound of claim 10, wherein n is 6.

21. The compound of claim 10, wherein R is an electron pair, R' is H_3N^+, W is $NH_2^+Cl^-$, and n is 1.

22. The compound of claim 10, wherein R is an electron pair, R' is H_3N^+, W is $NH_2^+Cl^-$, and n is 2.

23. The compound of claim 10, wherein R is an electron pair, R' is H_3N^+, W is $NH_2^+Cl^-$, and n is 4.

24. The compound of claim 10, wherein R is an electron pair, R' is H_3N^+, W is $NH_2^+Cl^-$, and n is 5.

25. The compound of claim 10, wherein R is an electron pair, R' is H_3N^+, W is $NH_2^+Cl^-$, and n is 6.

26. The compound of claim 10, wherein R is an electron pair, R' is H_3N^+, W is O, and n is 1.

27. The compound of claim 10, wherein R is an electron pair, R' is H_3N^+, W is O, and n is 2.

28. The compound of claim 10, wherein R is an electron pair, R' is H_3N^+, W is O, and n is 4.

29. The compound of claim 10, wherein R is an electron pair, R' is H_3N^+, W is O, and n is 5.

30. The compound of claim 10, wherein R is an electron pair, R' is H_3N^+, W is O, and n is 6.

31. The compound of claim 10, wherein R is an electron pair, R' is H, W is $NH_2^+Cl^-$, and n is 1.

32. The compound of claim 10, wherein R is an electron pair, R' is H, W is $NH_2^+Cl^-$, and n is 2.

33. The compound of claim 10, wherein R is an electron pair, R' is H^+, W is $NH_2^+Cl^-$, and n is 4.

34. The compound of claim 10, wherein R is an electron pair, R' is H, W is $NH_2^+Cl^-$, and n is 5.

35. The compound of claim 10, wherein R is an electron pair, R' is H, W is $NH_2^+Cl^-$, and n is 6.

36. The compound of claim 10, wherein R is an electron pair, R' is H, W is O, and n is 1.

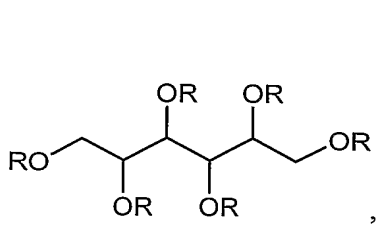
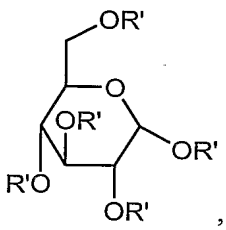
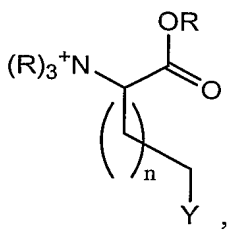
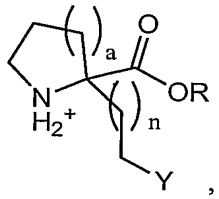
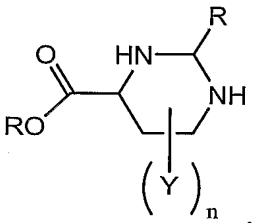
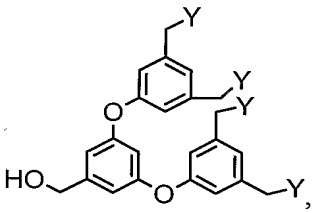
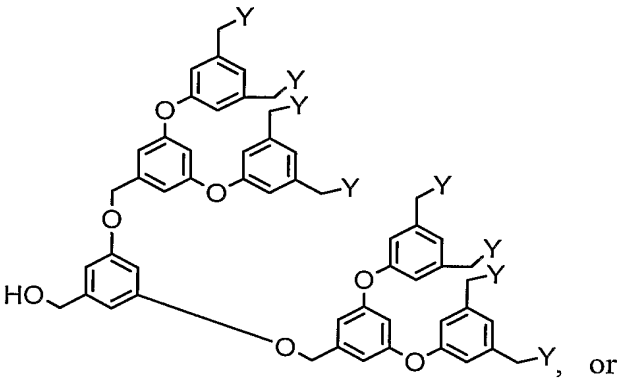
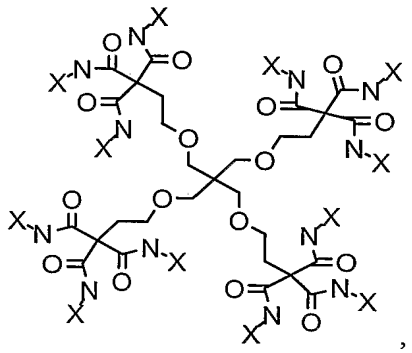
37. The compound of claim 10, wherein R is an electron pair, R' is H, W is O, and n is 2.

38. The compound of claim 10, wherein R is an electron pair, R' is H, W is O, and n is 4.

39. The compound of claim 10, wherein R is an electron pair, R' is H, W is O, and n is 5.

40. The compound of claim 10, wherein R is an electron pair, R' is H, W is O, and n is 6.

41. A compound selected from the group consisting of:


,

,

,

,

,

,

,
or

,

wherein, independently for each occurrence,

R is an electron pair, H, alkyl, aryl, heteroaryl, aralkyl, heteroaralkyl, an alkali metal, or CH_2Y;

R' is H, a sugar radical, or CH_2Y;

n is an integer from 1 to 100, inclusive;

a is 1, 2, or 3;

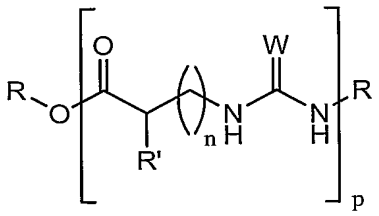
X is $C(CH_2Y)_3$; and

Y is a protein binding group,

wherein at least one Y is present in all compounds.

42. The compound of claim 41, wherein Y is a guanidinium ion.

43. A polymer of formula **II**, **III**, **IV**, **V**, **VI**, **VII**, **VIII**, or **IX**:



II

wherein, independently for each occurrence:

R is an electron pair, H, alkyl, aryl, heteroaryl, aralkyl, heteroaralkyl, or an alkali metal;

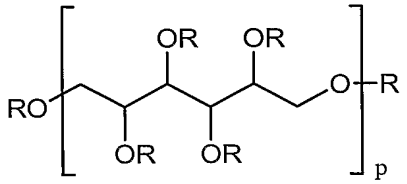
R' is H, alkyl, aryl, heteroaryl, aralkyl, heteroaralkyl, or $(R'')_3N$;

R" is an electron pair, H, alkyl, aryl, heteroaryl, aralkyl, or heteroaralkyl;

W is O, NH_2^+(halogen)$^-$, or S;

n is 1, 2, or 4-100; and

p is an integer from 2 to 1000 inclusive;



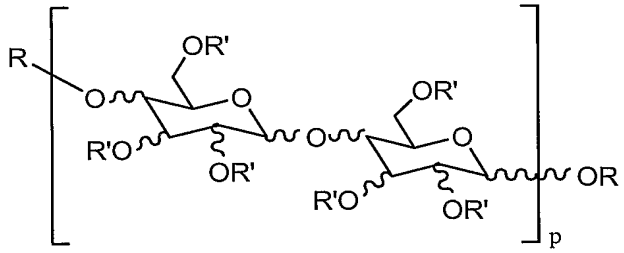
III

wherein, independently for each occurrence,

R is H, alkyl, aryl, heteroaryl, aralkyl, heteroaralkyl, or an alkali metal, or CH_2Y;

p is an integer from 2 to 1000 inclusive; and

Y is a PBG, wherein at least one Y is present;



IV

wherein, independently for each occurrence:

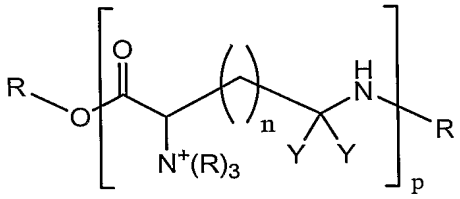
R is H, alkyl, aryl, heteroaryl, aralkyl, heteroaralkyl, or an alkali metal, or CH_2Y;

R' is H, alkyl, aryl, heteroaryl, aralkyl, heteroaralkyl, or $(R'')_3N$;

R" is an electron pair, H, alkyl, aryl, heteroaryl, aralkyl, or heteroaralkyl;

p is an integer from 2 to 1000 inclusive; and

Y is a PBG, wherein at least one Y is present;



V

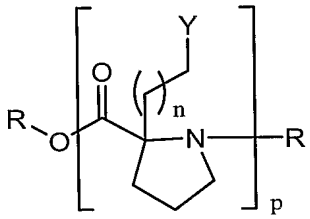
wherein, independently for each occurrence:

R is H, alkyl, aryl, heteroaryl, aralkyl, heteroaralkyl, or an alkali metal, or CH_2Y;

n is an integer from 1 to 100 inclusive;

p is an integer from 2 to 1000 inclusive; and

Y is a PBG;



VI

wherein, independently for each occurrence,

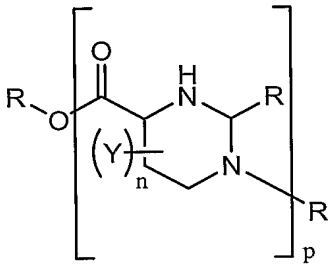
R is H, alkyl, aryl, heteroaryl, aralkyl, heteroaralkyl, an alkali metal, or CH_2Y;

n is an integer from 1 to 100, inclusive;

a is 1, 2, or 3;

Y is a PBG; and

p is an integer from 2 to 1000, inclusive;



VII

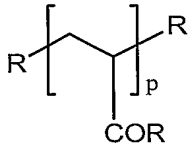
wherein, independently for each occurrence,

R is H, alkyl, aryl, heteroaryl, aralkyl, heteroaralkyl, an alkali metal, or CH_2Y;

n is an integer from 1 to 6, inclusive;

Y is a PBG; and

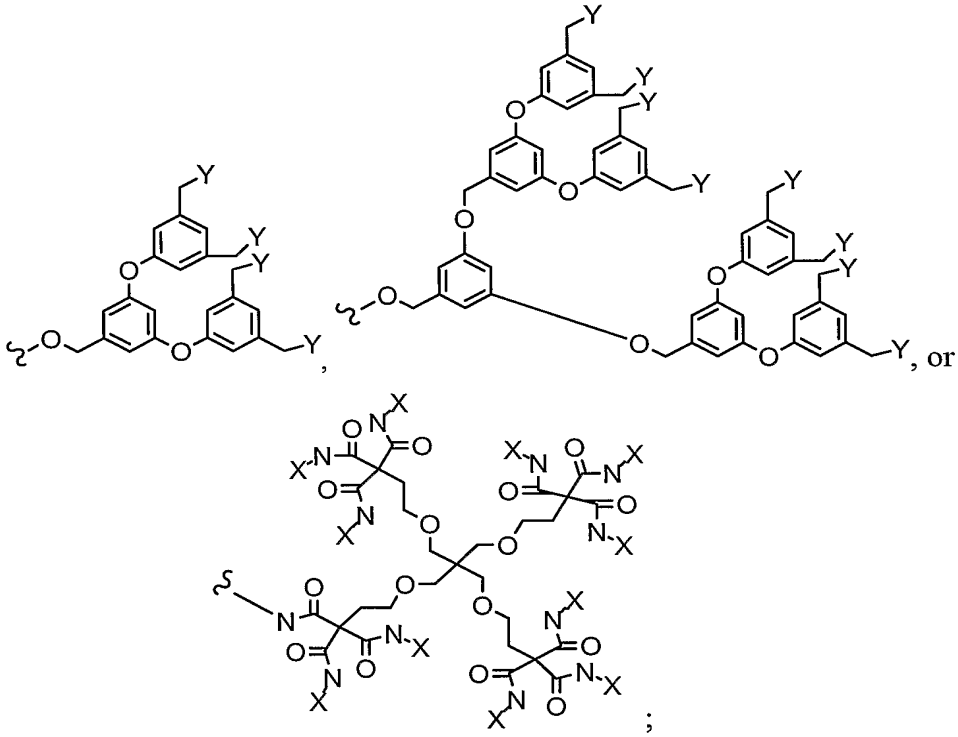
p is an integer from 2 to 1000, inclusive; or



VIII

wherein, independently for each occurrence,

R is H, OH, alkyl, alkoxy, aryl, heteroaryl, aralkyl, heteroaralkyl, -O-alkali metal, CH_2Y, OCH_2Y, or has a structure selected from the following:

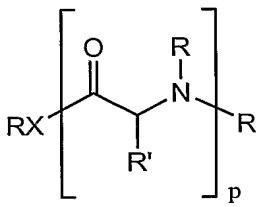


a is 1, 2, or 3;

X is $C(CH_2Y)_3$;

Y is a PBG, wherein at least one Y is present; and

p is an integer from 2 to 1000, inclusive; or



IX

wherein, individually for each occurrence:

R is an electron pair, H, alkyl, aryl, heteroaryl, aralkyl, heteroaralkyl, or an alkali metal;

R' is a sidechain of an alpha-amino acid, wherein at least one instance of R' is the sidechain of arginine;

X is O or NR; and

p is an integer from 2 to 1000, inclusive.

44. A method of screening compounds or polymers for the property of inhibiting protein aggregation in solution, comprising:

a) computing a set of parameters utilizing molecular modeling based on compounds or polymers known to have the property of inhibiting protein aggregation;

b) applying those parameters to other compounds or polymers; and

c) choosing the compounds or polymers that meet the criteria of those parameters.

45. A method of preparing a compound or polymers having the property of protein aggregation inhibition in solution, comprising:

a) computing a set of parameters utilizing molecular modeling based on compounds or polymers known to have the property of inhibiting protein aggregation;

b) designing a compound or polymer having the property of protein aggregation inhibition in solution based on those parameters; and

c) synthesizing the compound or polymer having the property of protein aggregation inhibition in solution.

46. A method of classifying a compound or polymer as either inhibitory of protein aggregation in solution or not inhibitory of protein aggregation in solution, comprising:

a) computing a set of parameters utilizing molecular modeling based on compounds or polymers known to have the property of inhibiting protein aggregation;

b) applying those parameters to a compound or polymer; and

c) classifying the compound or polymer that meet the criteria of those parameters as inhibitory of protein aggregation in solution.

47. A method of determining the preferential binding coefficient, Γ_{XP}, of an additive in a protein solution, comprising:

a) determining the phase space trajectories of the protein, solvent, and additive using molecular dynamics;

b) calculating the distance, r, between the center of mass for both the solvent molecule and additive molecule to the protein's van der Waals surface;

c) determining the minimum distance, r*, at which no significant differences between the local (r = r*) and bulk density are observed;

d) determining which molecules lie within the distance, r*, from the protein surface and classifying these molecules as the local domain;

e) determining which molecules lie outside the distance, r*, from the protein surface and classifying these molecules as the bulk domain;

f) determining the instantaneous preferential binding coefficient, $\Gamma_{XP}(t)$, using the following formula:

$\Gamma_{XP}(t) = n^{II}_X - n^{I}_X (n^{II}_W / n^{I}_W)$

wherein:

n^{II}_X = the number of additive molecules in the bulk domain;

n^{I}_X = the number of additive molecules in the local domain;

n^{II}_W = the number of solvent molecules in the bulk domain; and

n^{I}_W = the number of solvent molecules in the local domain; and

g) calculating the preferential binding coefficient, Γ_{XP}, as the time average of each of the values in step f) using the following formula:

$$\Gamma_{XP} = \frac{1}{t}\int_0^t \Gamma_{XP}(t')dt'.$$

48. A method of suppressing or preventing aggregation of a protein in solution, comprising the step of combining in a solution the compound or polymer of any of claims 1 to 43 and a protein.

49. The method of claim 48, wherein the protein is a recombinant protein.

50. The method of claim 48, wherein the protein is a recombinant antibody.

51. The method of claim 48, wherein the protein is a recombinant human antibody.

52. The method of claim 48, wherein the protein is a recombinant human protein.

53. The method of claim 48, wherein the protein is recombinant human insulin, recombinant human erythropoietin or a recombinant human interferon.

54. The method of claim 48, wherein the solution is an aqueous solution.

55. The method of claim 48, wherein the protein is a recombinant protein; and the solution is an aqueous solution.

56. The method of claim 48, wherein the protein is a recombinant human protein; and the solution is an aqueous solution.

57. A method of decreasing the toxicological risk associated with administering a protein to a mammal in need thereof, comprising the steps of adding to a first solution of a protein a compound or polymer of any of claims 1 to 43 to give a second solution; and administering to a mammal in need thereof a therapeutic amount of said second solution.

58. The method of claim 57, wherein the protein is a recombinant protein.

59. The method of claim 57, wherein the protein is a recombinant antibody.

60. The method of claim 57, wherein the protein is a recombinant human antibody.

61. The method of claim 57, wherein the protein is a recombinant mammalian protein.

62. The method of claim 57, wherein the protein is a recombinant human protein.

63. The method of claim 57, wherein the protein is recombinant human insulin, recombinant human erythropoietin or a recombinant human interferon.

64. The method of claim 57, wherein the first solution and the second solution are aqueous solutions.

65. The method of claim 57, wherein the protein is a recombinant protein; and the first solution and the second solution are aqueous solutions.

66. The method of claim 57, wherein the protein is a recombinant human antibody; and the first solution and the second solution are aqueous solutions.

67. The method of claim 57, wherein the protein is a recombinant human protein; and the first solution and the second solution are aqueous solutions.

68. A method of facilitating native folding of a recombinant protein in solution, comprising the step of combining in a solution a compound or polymer of any of claims 1 to 43 and a recombinant protein.

69. The method of claim 68, wherein the recombinant protein is a recombinant antibody.

70. The method of claim 68, wherein the recombinant protein is a recombinant human antibody.

71. The method of claim 68, wherein the recombinant protein is a recombinant mammalian protein.

72. The method of claim 68, wherein the recombinant protein is a recombinant human protein.

73. The method of claim 68, wherein the recombinant protein is recombinant human insulin, recombinant human erythropoietin or a recombinant human interferon.

74. The method of claim 68, wherein the solution is an aqueous solution.

75. The method of claim 68, wherein the recombinant protein is a recombinant human antibody; and the solution is an aqueous solution.

76. The method of claim 68, wherein the recombinant protein is a recombinant human protein; and the solution is an aqueous solution.